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EDITORIAL

Editorial special issue on cyanobacterial blooms and water ecological restoration

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Cyanobacterial bloom formation and aquatic ecosystem degradation driven by global warming and eutrophication have become serious ecological and environmental problems worldwide. Recently, great progress in physiology of cyanobacteria has been achieved, but our knowledge on the mechanisms of bloom formation of cyanobacterial species and the feasible methods for ecological restoration is still poor.

The 6th Forum on Cyanobacterial Blooms, organized by the Northwest Agriculture and Forest University, Yangling, China, in 22–23 June 2019, was held to share most recent research progress in cyanobacterial blooms and ecological restoration around China. This forum was held annually since 2014. The forum was jointly proposed and initiated by Prof. Guoxiang Wang from Nanjing Normal University and Prof. Renhui Li from the Institute of Hydrobiology, Chinese Academy of Sciences. Since then, the form has covered a wide variety of topics, including the most common toxic bloom-forming cyanobacterium *Microcystis*, cyanobacteria blooms and nutrient cycling in shallow lakes, interactions between cyanobacterial bloom formation and physical, chemical, and biological factors, as well as monitoring and early warning of cyanobacterial blooms.

This Special Issue of Environmental Science and Pollution Research comprises selected papers presented in the 6th Forum on Cyanobacterial Blooms. In detail, 13 communications are presented in this special issue, elucidating the following topics:

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1. Phytoplankton and bacterioplankton community

Wei et al. (2020) compared the variation in annual phytoplankton community responding to varying environmental factors in two urban landscape lakes. This work is potentially interesting because artificial lakes with shorter formed time were investigated while most literatures related to phytoplankton community variation focused on natural lakes or reservoirs. Du et al. (2020) investigated the bacterioplankton spatial distribution patterns and its determinants in a typical urban lake in eastern China (West Lake) by 16S rRNA gene high-throughput sequencing. A feasibility study on the pigment composition method evaluating phytoplankton composition (CHEMTAX-HPLC method) was carried out from a river system (Weihe River, Northwest China) and suggested that CHEMTAX-HPLC method was not accurate enough to characterize the phytoplankton communities in the freshwater ecosystem (Tian et al. 2019). Long et al. (2020) illustrated that morphology-based functional groups of phytoplankton could be an effective biological water quality indicator based on a case study in the Pearl River, South China.

2. *Microcystis* colony formation and structure

Li et al. (2020) reported that the extract of aquatic macrophyte *Carex cinerascens* induced colony formation in the bloom-forming cyanobacterium *Microcystis* and suggested that plant allelopathy was one of the major factors contributing to colony formation in *Microcystis*. The material basis of *Microcystis* colony formation was always considered as extracellular polysaccharides. Zu et al. (2020) found that cell wall surface layer (S-layer) would also be the material basis promoting colony formation in *Microcystis* by comparison of S-layer characteristics between colonial and unicellular forms of *Microcystis* and function conformation. Wu et al. (2020) optimized a method for measuring the compactness of *Microcystis*

colonies and made insight into the relationships between the volume ratio of cells to the colony and floating velocity of various sized colonies. Their results suggested that compactness may be an active regulation strategy for *Microcystis* colonies to promote buoyancy.

3. Cyanobacterial blooms and ecological restoration in Lake Taihu, China

Chen et al. (2020) investigated the variation in the area of cyanobacterial blooms in Lake Taihu after a typhoon employing a 6-year field investigation in Lake Taihu and satellite data analysis. They found that short-term nutrient release during a typhoon did not result in an obvious increase in *Microcystis* cell density but the horizontal migration of *Microcystis* colonies would be the reason why the area of a cyanobacterial bloom increases in Lake Taihu after a typhoon passes. Qi et al. (2020) focused on the concentration and characterization of odorants in Lake Taihu and found that the concentration in the water of cyanobacterial blooms zones was approximately 3 to 21 times higher than that in macrophyte-dominated zones. An outdoor mesocosm water ecological restoration experiment was conducted in Lake Taihu by Han et al. (2019), and their results suggested that it was necessary to continuously remove the juvenile benthivorous fish several times for restoring the submerged macrophytes in shallow lakes.

4. Algal physiology and cultivation in the laboratory

Bai et al. (2020) studied the interspecific competition between *Cylindrospermopsis raciborskii* and *Microcystis aeruginosa* on different phosphorus substrates in laboratory and indicated that advantages for *C. raciborskii* would be dominated in natural waters with dissolved inorganic phosphorus limitation or dissolved organic phosphorus. Zhang et al. (2020) studied the response of extracellular and intracellular alkaline phosphatase activity (APA) of *Microcystis* to β-glycerol-phosphate (β-GP) and lecithin (LEC). They indicated that *Microcystis* in the LEC groups could secret more extracellular APA compared with the β-GP treatment. Yan et al. (2020) used Monte Carlo method to simulate the illumination distribution inside a cylindrical photobioreactor for wastewater treatment. Their approach provides new insights for improving the efficiency and scalability of photobioreactors for wastewater treatment to reduce nutrient input and slow eutrophication in reservoirs and lakes.

In summary, the field investigations focusing on phytoplankton community and laboratory experiments studying algal physiology were carried out frequently, and researches on cyanobacterial bloom control and ecological restoration are still needed for better management of our drinking water supplies.

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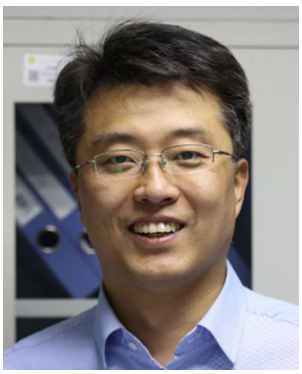

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